

Moorhead, Minnesota: at 10.45 p. m. on the 18th was observed in the north an arc of light, 2° in width, resting on a base of haze; at 11 p. m. the arc broke into streamers, extending toward the zenith; at 11.45 only a dim light remained. A display, exhibiting no marked features, was also observed at this station at 11 p. m. of the 23d.

Escanaba, Michigan: a faint aurora was observed from 9.40 to 11.25 p. m. of the 18th; the light was of a pale yellowish color, and at times, was obscured by cirro-stratus cloud. A similar display also occurred during the night of the 23-24th, beginning at 10 p. m. and lasting until 12.33 a. m.

Cambridge, Massachusetts: an auroral arch was observed at 9 p. m., on the 18th.

Point Judith, Rhode Island: an auroral display, resembling the morning dawn, was seen at 1.30 a. m. of the 19th; it was obscured by fog at 2.15 a. m.

Oswego, New York: a faint auroral light of whitish color was observed in the north from 10 to 11.15 p. m. of the 22d.

Burlington, Vermont: from 2.15 until 2.45 a. m. of the 26th, a bright yellowish, auroral light was observed.

West Washington, District of Columbia: a diffuse auroral light was seen in the northern sky at 9 p. m. of the 26th, lasting an hour.

Syracuse, New York: a faint aurora was observed at 11 p. m. of the 30th.

Auroral displays are reported to have been observed at the following places—no descriptions nor time at which they were observed, being given:

Yutan, Nebraska, 13th, 15th, 20th, 21st, 23d.

Quakertown, Pennsylvania, 15th.

Vevay, Indiana, 17th, 19th.

Swartz Creek, Michigan, 18th, 22d.

Traverse City, Michigan, 22d.

Manchester, Iowa, 24th.

#### THUNDER-STORMS.

Thunder-storms have been reported in the various districts on the following dates:

*New England.*—2d, 3d, 5th to 10th, 13th, 19th, 20th, 21st, 23d to 26th.

*Middle Atlantic states.*—3d, 5th, 6th, 8th to 13th, 19th to 26th, 29th, 30th.

*South Atlantic states.*—6th to 16th, 19th to 22d, 24th to 30th.

*Florida peninsula.*—5th to 17th, 19th, 21st to 30th.

*Eastern Gulf states.*—3d to 10th, 12th to 18th, 20th to 30th.

*Western Gulf states.*—1st to 5th, 7th, 8th, 9th, 12th to 30th.

*Rio Grande valley.*—18th, 21st, 23d, 25th, 26th, 27th, 29th.

*Tennessee.*—2d, 3d, 5th to 14th, 17th to 30th.

*Ohio valley.*—2d, 3d, 6th to 14th, 17th to 25th, 27th, 30th.

*Lower lake region.*—1st to 10th, 12th, 13th, 17th to 25th, 30th.

*Upper lake region.*—1st to 9th, 12th, 16th to 24th, 30th.

*Extreme northwest.*—3d to 6th, 10th to 15th, 17th, 20th to 30th.

*Upper Mississippi valley.*—1st to 10th, 12th, 13th, 15th to 25th, 28th, 29th, 30th.

*Missouri valley.*—1st, 4th to 8th, 11th to 25th, 28th, 29th, 30th.

*Northern slope.*—1st to 11th, 13th to 16th, 19th to 24th, 26th to 30th.

*Middle slope.*—1st to 11th, 13th to 30th.

*Southern slope.*—1st, 2d, 4th to 8th, 11th to 20th, 22d, 26th.

*Southern plateau.*—1st, 6th, 10th, 13th to 16th, 18th to 21st, 26th to 30th.

*Middle plateau.*—1st to 4th, 12th, 13th, 15th, 21st, 25th, 27th.

*Northern plateau.*—2d to 5th, 9th, 11th, 12th, 13th, 18th, 19th, 21st, 22d, 23d, 25th.

*North Pacific coast region.*—1st, 2d, 4th, 8th, 14th, 18th, 21st, 22d, 23d, 25th, 26th, 28th, 30th.

*Middle Pacific coast region.*—Fort Gaston and Hydesville, California, 1st; Princeton, California, 1st to 4th; College City, California, 3d and 4th.

*South Pacific coast region.*—Los Angeles, California, 13th.

#### ELECTRICAL PHENOMENA.

The observer at Cantonment, Indian Territory, reports that a remarkable phenomenon is often witnessed at the "Red" hills about twenty-eight miles east of that station. The most prominent hill of that group—a ridge several miles in extent, is, during the prevalence of thunder storms, the scene of a wonderful electrical display, the lightning flashing along the entire length of the ridge. It is supposed to be due to this phenomenon that these hills are regarded by the Indians as a "medicine ground," and have long been used by them as a place for their superstitious religious ceremonies.

At West Las Animas, Colorado, between 8 and 9 p. m. of the 16th, the wind-vane was tipped with electric light.

The telegraph line at Fort Assinaboine, Montana, was affected by atmospheric electricity on the 16th.

The observer at Huron, Dakota, reports that at 3 p. m. of the 24th, a vivid flash of sheet lightning spread over the entire sky, the weather being perfectly clear at that time.

#### OPTICAL PHENOMENA.

##### SOLAR HALOS.

Solar halos were observed in the various districts on the following dates:

*New England.*—2d, 6th, 7th, 14th, 22d, 26th, 27th.

*Middle Atlantic states.*—6th, 7th, 10th, 13th, 14th, 24th, 28th.

*South Atlantic states.*—3d, 4th, 6th to 9th, 11th, 23d, 25th, 26th, 30th.

*Florida peninsula.*—4th, 5th, 15th, 16th, 20th.

*Eastern Gulf states.*—3d, 4th, 8th, 9th, 17th, 22d.

*Western Gulf states.*—2d, 6th, 7th, 9th, 11th, 13th, 19th, 20th.

*Tennessee.*—1st, 2d, 4th, 8th, 12th, 13th, 17th.

*Ohio valley.*—4th, 20th.

*Lower lake region.*—1st, 3d, 5th, 6th, 11th, 19th, 20th, 22d, 23d, 26th.

*Upper lake region.*—2d, 3d, 8th, 9th, 18th, 20th, 21st, 22d.

*Upper Mississippi valley.*—1st, 23d, 24th.

*Missouri valley.*—1st, 9th, 11th, 15th, 17th, 25th.

*Middle slope.*—13th.

*Southern plateau.*—11th.

*Middle plateau.*—3d, 5th to 10th, 21st.

*Northern plateau.*—3d, 4th, 5th, 7th.

*North Pacific coast region.*—6th, 17th, 19th, 21st.

*Middle Pacific coast region.*—2d, 3d, 6th, 11th, 15th, 17th, 20th, 27th.

*South Pacific coast region.*—3d.

Dr. J. B. Trembley, of Oakland, California, reports that during the early morning of the 3d the sky was overcast; at 8.30 a. m. it cleared; between 10 a. m. and 1 p. m. was visible one of the most brilliant solar halos that he has observed during a residence of many years at Oakland. The halo gave out, quite distinctly, the prismatic colors of the rainbow, and its brilliancy caused a peculiar shadow or obscurity to the sun's rays, resembling the darkness caused by the solar eclipse. Dr. Trembley states that it is worthy of remark that this brilliant solar halo preceded one of the severest storms (see "local storms") that ever occurred in that region during the month of June.

##### LUNAR HALOS.

Lunar halos were observed on the following dates in the various districts:

*New England.*—2d, 3d, 5th, 6th, 7th, 21st.

*Middle Atlantic states.*—3d to 9th, 30th.

*South Atlantic states.*—2d, 3d, 5th, 6th, 30th.

*Florida peninsula.*—5th.

*Eastern Gulf states.*—1st, 2d, 29th.

*Western Gulf states.*—4th, 7th, 8th, 9th, 13th, 15th, 19th.

*Tennessee.*—1st, 2d, 3d, 8th.

*Ohio valley.*—1st to 8th.

*Lower lake region.*—1st, 5th, 6th, 9th, 11th, 18th.

*Upper lake region.*—1st, 3d, 7th, 12th, 15th.

*Upper Mississippi valley.*—1st, 3d, 6th.

*Missouri valley.*—2d, 4th, 5th, 8th.

*Northern slope.*—6th.

*Middle slope.*—1st, 5th, 7th.

*Southern plateau.*—1st, 4th.

*Middle plateau.*—3d, 5th, 7th, 8th.

*North Pacific coast region.*—4th, 5th, 7th, 8th.

*Middle Pacific coast region.*—2d, 11th.

*South Pacific coast region.*—2d.

#### MIRAGE.

Mr. D. F. G. Crawford, of Allegheny City, Pennsylvania, reports that, on June 11th, the flames from the McGuigan natural-gas well, sixteen miles distant, were distinctly visible in two places. Between the natural-gas well and Allegheny City, intervenes a hill, at least two hundred and fifty feet in height, and ordinarily only a faint glow from the flame is observed. A similar phenomenon was observed at this place, March 16th, 1884.

Fort Macon, North Carolina: at 8.45 a. m. of the 13th the image of a group of trees north of this station appeared to be elevated 15° above the horizon.

Point Judith, Rhode Island: from 5.30 p. m. until after sunset on the 16th, Block Island, with its inverted image above it, appeared several miles nearer than its actual distance from this place. The smoke from the steamers on the sound settled in a narrow band parallel to the horizon and at the same altitude as the inverted image of the island. Vessels to the south-westward appeared twice their actual height—the topmasts meeting the band of smoke above mentioned.

New London, Connecticut: from 6.30 to 7.20 p. m. of the 23d, the images of several vessels beyond the horizon were observed (not inverted) at an altitude of 15°.

Mirage was also observed at the following places:

Indianola, Texas, 4th, 6th.

Galveston, Texas, 5th.

Salina, Kansas, 14th, 25th.

#### MISCELLANEOUS PHENOMENA.

##### SUNSETS.

The characteristics of the sky as indicative of fair or foul weather for the succeeding twenty-four hours have been observed at all Signal Service stations. Reports from one hundred and sixty stations show 4,765 observations to have been made, of which two were reported doubtful; of the remainder, 4,763, there were 3,936, or 82.6 per cent., followed by the expected weather.

##### SUN SPOTS.

Professor David P. Todd, director of the Lawrence Observatory, Amherst, Massachusetts, furnishes the following record of sun spots for June, 1884:

Date— June, 1884.	No. of new		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. visible.		Remarks.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
1, 6 p. m....	0	0	0	10†	0	0	8	30†	
2, 12 m.....	1	15†	0	0	1	15†	9	50†	
4, 10 a. m....	0	0	5	20†	0	0	4	30†	
5, 9 a. m....	1	3	0	0	1	3	5	35†	
6, 10 a. m....	0	0	0	0	0	0	5	35†	
7, 1 p. m....	0	0	0	0	0	0	5	40†	
8, 4 p. m....	1	10†	0	0	0	0	6	50†	
9, 3 p. m....	1	1	0	0	1	1	7	30†	
13, 11 a. m....	4	10†	0	0	0	0	8	15†	
14, 11 a. m....	1	1	0	0	1	1	7	10†	
15, 11 a. m....	0	0	0	0	0	0	5	7	
16, 4 p. m....	1	5†	1	1	1	1	6	12†	
17, 5 p. m....	1	2	0	0	1	2	7	14†	
18, 6 p. m....	0	0	0	0	0	0	5	15†	
20, 2 p. m....	1	5†	0	0	0	0	6	20†	
21, 4 p. m....	0	5	0	0	0	0	6	25†	
22, 5 p. m....	0	0	0	0	0	0	5	20†	
23, 12 m.....	1	1	0	0	1	1	6	20†	
24, 3 p. m....	0	0	1	2	0	0	4	10	
26, 4 p. m....	2	7	0	2	2	7	4	15	
27, 5 p. m....	2	3	0	2	2	3	7	15†	
28, 6 p. m....	0	0	1	5	0	0	5	12†	
29, 5 p. m....	0	10†	0	0	0	0	5	25†	
30, 4 p. m....	0	15†	0	0	0	0	5	40†	Faculae abundant.

Faculae were seen at the time of every observation. †Approximated.

Mr. William Dawson, of Spiceland, Henry county, Indiana, furnishes the following record of sun spots for June, 1884:

Date.	Hour of observation.	Number of groups.	Number of spots.	Remarks.
1st.....	9.15 a. m....	5	53	
2d.....	8.20 a. m....	5	60	
4th.....	8.15 a. m....	5	40	
5th.....	8.15 a. m....	5	60	
7th.....	4.20 p. m....	5	37	
13th.....	7.40 a. m....	3	12	
15th.....	9.45 a. m....	3	6	
17th.....	8.40 a. m....	5	21	
18th.....	8.40 a. m....	6	45	
19th.....	8.00 a. m....	5	25	
21st.....	8.00 a. m....	5	47	
22d.....	5.00 a. m....	5	47	
23d.....	8.20 a. m....	4	36	
27th.....	9.00 a. m....	5	20	
28th.....	8.00 a. m....	5	23	
30th.....	8.15 a. m....	5	40	

#### DROUGHT.

*Arkansas.*—Lead Hill, Boone county: although the rainfall for June at this place was 3.60 inches, the rains were remarkably local, and in surrounding localities drought prevailed.

*Connecticut.*—Hartford: no rain fell during the first eleven days of the month; on the 12th and 13th two very light showers fell; after these dates there was no rain until the storm of the 25th and 26th, which was accompanied by heavy rain. During the first and second decades of the month the drought was very severe and caused great damage to vegetation, especially to the hay crop.

New Haven, 24th: rain is seriously needed in the farming districts of this state. It is reported that the condition of the grass crop indicates that the yield will be the lightest for many years past. The apple crop is also seriously affected, the trees being injured by canker worms. The drought was terminated by the heavy rains of the 25th and 26th.

*Michigan.*—Port Huron, 8th: the weather is very warm and dry, and vegetation is badly parched; rain is much needed in this section.

*New York.*—Westchester, Westchester county, 22d: the farmers in this vicinity state that all crops, especially potatoes and corn, are suffering for rain.

*North Carolina.*—Scott's Hill, Pender county: reports from the surrounding country on the 19th and 20th stated that crops were suffering in consequence of drought. A much needed and abundant rainfall occurred on the 27th.

*Pennsylvania.*—Erie: the heavy rains of the 10th were of great benefit to the grass crop in this region which, before the above date, was suffering from drought.

*Texas.*—Rio Grande City, 24th: the soil is very dry and hard and all vegetation is much burned by the extremely hot and dry weather; there is also an insufficient supply of water for stock.

*Virginia.*—Johnsontown, Northampton county: from May 20th to June 24th, the total rainfall was only 0.15 inch; as a result, one of the severest droughts prevailed that has ever been experienced in this country.

#### METEORS.

Fort Gaston, California: a brilliant meteor, apparently of about 30' diameter, was observed in the north-northwestern sky at 8.15 p. m. of the 1st. The whole sky was illuminated as if by a flash of lightning; there were two visible explosions.

Lynchburg, Virginia: at 9.04 p. m. of the 23d a very large meteor was observed moving rapidly northward; it exploded when about 10° above the horizon. During its flight a whizzing noise was heard but no report was heard at its explosion. At about the same hour a meteor (probably the same) of this description was observed at Staunton, Virginia.

The following reports probably refer to the same meteor:

Variety Mills, Nelson county, Virginia: a brilliant meteor was observed at about 9.10 p. m. on the 23d. It started in the southwestern sky about midway between the horizon and zenith,